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TASK SCHEDULING IN CLOUD COMPUTING USING PARTICLE SWARM OPTIMIZATION ALGORITHM

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Abstract: Task scheduling is a fundamental problem in computer science that involves allocating computational resources to a set of tasks in an efficient and timely manner. The optimization of task scheduling is crucial in improving system performance, reducing execution time, and maximizing resource utilization. Particle Swarm Optimization (PSO) is a metaheuristic algorithm inspired by the collective behavior of bird flocking or fish schooling. This abstract presents a novel approach to task scheduling using Particle Swarm Optimization. The proposed method aims to find an optimal scheduling solution by leveraging the inherent parallelism and exploration capabilities of PSO. The problem is formulated as a multi-objective optimization task, considering objectives such as minimizing makespan, load balancing, and energy consumption. In the proposed approach, a population of particles represents potential task schedules, where each particle's position corresponds to a specific scheduling solution. The particles collaborate by sharing information about their best-known positions, called personal bests, and the overall best-known position, called the global best. Through a series of iterations, particles update their positions based on their own experience and the collective knowledge of the swarm. To guide the search process, a fitness function is defined that evaluates the quality of a scheduling solution based on the specified objectives. The fitness function considers factors such as task dependencies, resource constraints, and system characteristics. By iteratively evaluating and updating the fitness values, the PSO algorithm gradually converges towards an optimal or near-optimal scheduling solution. Experimental results on benchmark task scheduling problems demonstrate the effectiveness of the proposed PSO-based approach. It achieves significant improvements in terms of makespan reduction, load balancing, and energy efficiency compared to traditional scheduling algorithms. The approach also exhibits robustness and scalability, allowing it to handle larger problem instances efficiently.

***Index Terms* – Task Scheduling, Cloud Computing, Particle Swarm Optimization(PSO), Best-Fit(BF), Global-Fit(GF), Cloud Sim Tool, Virtual Machines.**

I. INTRODUCTION

Task scheduling is a crucial aspect of optimizing system performance and resource utilization in various domains, such as cloud computing, distributed systems, and parallel computing. Traditional task scheduling algorithms face challenges in effectively balancing the workload and minimizing the execution time. To address these challenges, researchers have turned to nature-inspired optimization algorithms, one of which is Particle Swarm Optimization (PSO). This paper presents a comprehensive study on task scheduling using PSO, exploring its theoretical foundations, algorithmic implementation, and practical applications. The goal is to provide readers with a detailed understanding of PSO-based task scheduling techniques and their potential for enhancing system performance.

II. LITERATURE SURVEY

In many studies, different types of techniques and algorithms were used in scheduling tasks in cloud computing.

DeafallahAlsadie [1] In order to identify near-optimal task scheduling solutions while handling competing objectives, this paper proposes a metaheuristic approach called Task Schedule utilising a Multi-objective Grey Wolf Optimizer (TSMGWO).

N. Bacanin, TimeaBezdan, Eva Tuba, I. Strumberger, M. Tuba, M. Zivkovic [2] In this study, we suggest a metaheuristic task scheduling technique. The algorithm used in the suggested scheduler, the grey wolf optimizer, was inspired by nature. The quality and reliability of the suggested procedure are demonstrated by the experimental findings.

Kun Li, Lewei Jia, Xiaoming Shi [3] Proposed a membrane computing and particle swarm optimization combined scheduling approach for cloud computing tasks. First, a paradigm for task scheduling that uses time and cost functions as its targets is suggested. Next, chaotic operation is employed in population initialization on the foundation of the particle swarm method to increase the diversity of rich knowledge. To prevent the algorithm from reaching a local optimum, adaptive weighting based on sinusoidal function is applied. We compare the performance of the PSOMC method with six benchmark test functions.

Farouk A. Emara, Ahmed. A. A. Gad-Elrab, Ahmed Sobhi, K. R. Raslan [4] A new job scheduling method is suggested by the study based on these goals for effective resource management. This proposed solution employs a modified genetic algorithm to identify the best servers to deploy these VMs on and the best VMs to use for completing tasks that have been received (GA). The genome of GAS is represented by this proposed method using a matrix structure that combines the ids of jobs, VMs, and servers.

Raj Kumar Kalimuthu, Brindha Thomas [5] A multi-objective parallel machine scheduling method was proposed in this study using the oppositional grey wolf's optimization (OGWO). We proposed an unique method that combines the GWO with opposition-based learning (OBL), where OBL improves the performance of the GWO algorithm while optimising the task and resources, in order to achieve the multi-objective function.

K. Lalitha Devi, S. Valli [6] The primary contribution of the study is a developed scheduling algorithm that plans cloud jobs by figuring out how many virtual machines will be required in the near future, together with their anticipated CPU and memory needs. The K-means algorithm groups the tasks depending on criteria like CPU and memory utilisation.

Yefeng Yang, Bo Yang, Shilong Wang, TianguoJin, Shi Li [7] The multi-objective service composition and optimal selection (MO-SCOS) problem in cloud manufacturing is addressed in this paper using an improved multi-objective grey wolf optimizer (EMOGWO), where both service quality and energy consumption are taken into account from the standpoints of sustainable manufacturing. Given that the original multi-objective grey wolf optimizer still has issues with local optimum and variety (MOGWO).

III. EXISTING SYSTEM

It can be seen that there is no appreciable difference between GA and PSO when applied to scenarios with modest amounts of data. As the number of variables rises, GA's accuracy starts to decline. It's necessary to use some methods of population decline or chromosomal eradication to maintain great accuracy. When the optimum fitness value for one generation does not change before the stipulated time, this strategy is used. In this instance, the fitness value of one generation exceeds the saturation threshold, resulting in the annihilation of all except the best chromosomes from that generation. the new N-1 chromosomal population is then supplemented with the best chromosomes. This procedure in GA continues until it meets the termination requirements. Even though this method can increase accuracy. GA is not always able to find the optimal solution to each iteration on a medium and large scale. In contrast to GA, PSO has a stable condition in finding the optimal solution.

IV. PROPOSED SYSTEM

To evaluate the best time the user is using the VM and find out the best time and time spent in work by the user by using PSO algorithm. It demonstrate that PSO can have better results in a faster and cheaper way compared to other methods. It will work on a very wide variety of tasks which makes it very powerful and flexible algorithm. PSO obtains the best solution from particles' interaction It requires minimal parameter tuning and has fewer control parameters, making it suitable for a wide range of optimization problems.

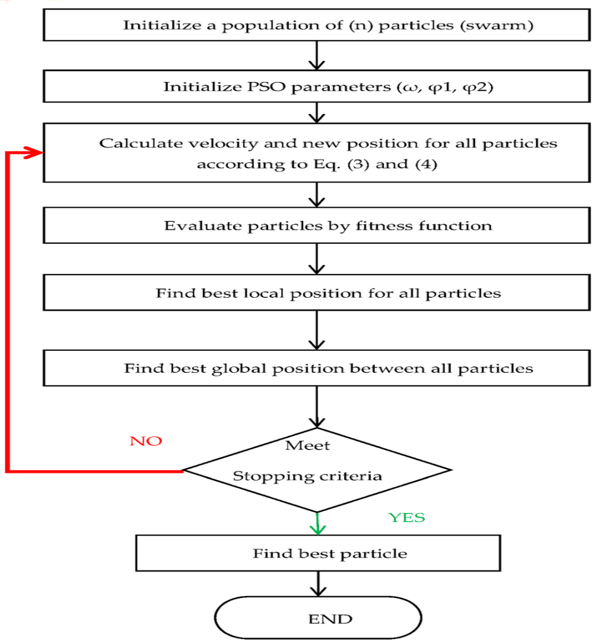


Fig 1: Block diagram of Particle Swarm Optimization Algorithm

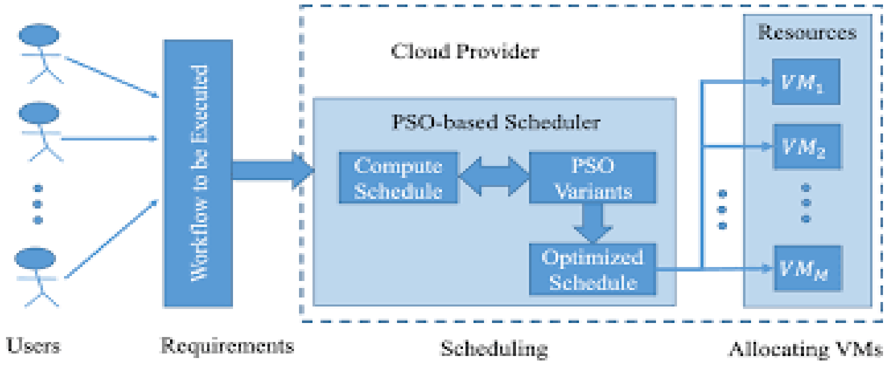
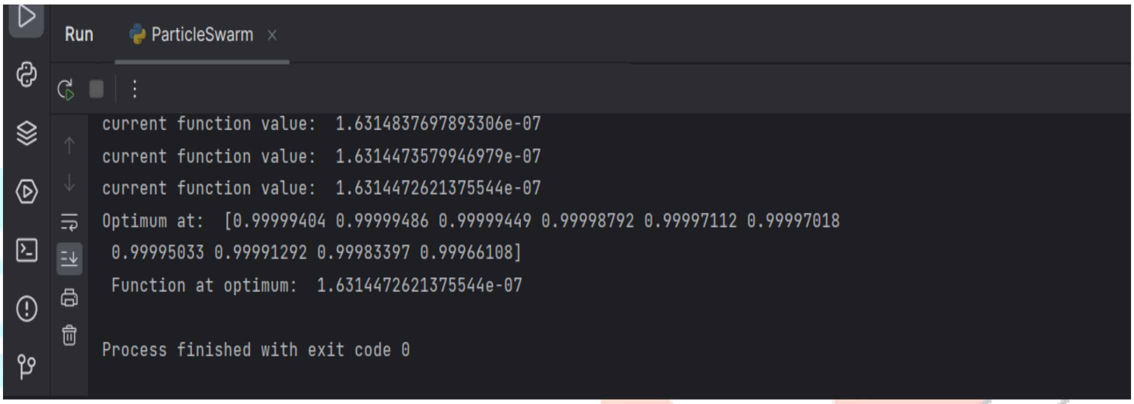


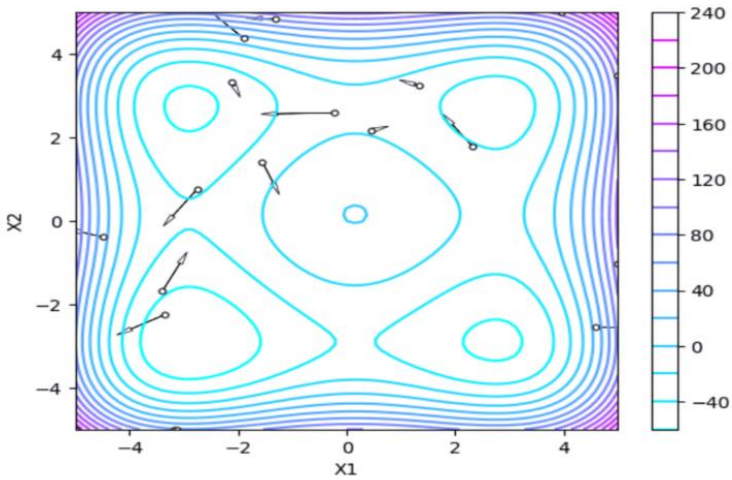
Fig 2: Architecture of PSO With Task Scheduling

V. RESULTS

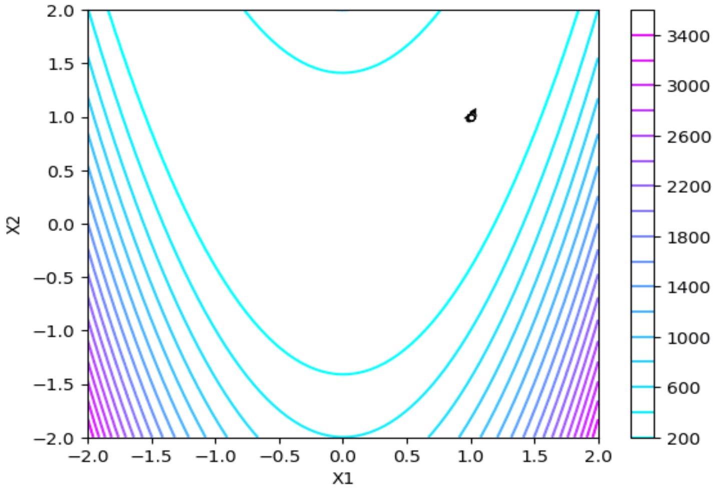
Fitness Function



Particle Representation



Particle Update



Results Comparison with Existing System

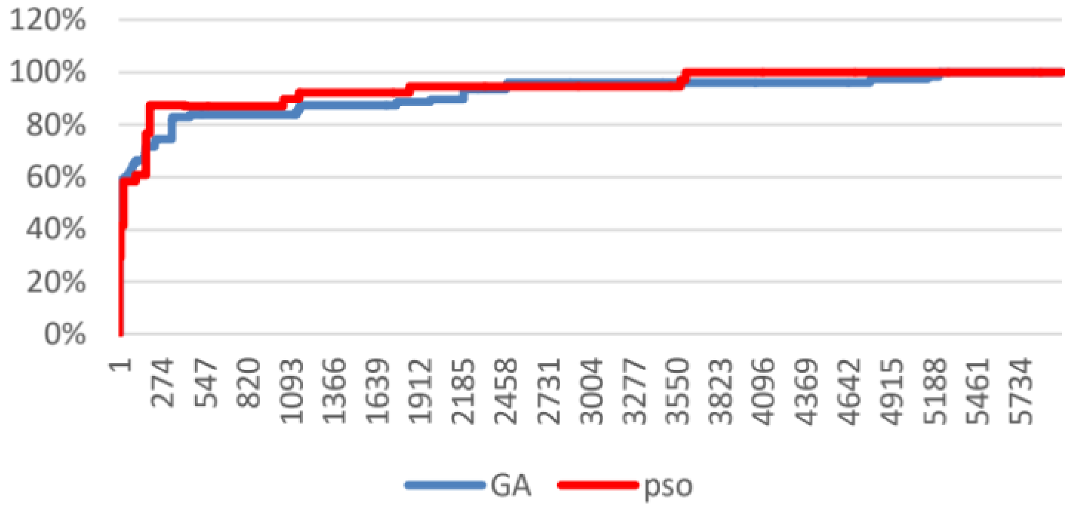


FIG 3: COMPARISON BETWEEN EXISTING SYSTEM AND PROPOSED SYSTEM

VI. CONCLUSION

Particle Swarm Optimization (PSO) is a powerful metaheuristic optimization algorithm inspired by the collective behavior of social organisms such as bird flocking or fish schooling. It has been extensively studied and applied to wide range of optimization problems in various fields. PSO has proven to be effective in finding optimal or near-optimal solutions in both continuous and discrete search spaces.

One of the main advantages of PSO is its simplicity and ease of implementation compared to other optimization algorithms. It requires minimal parameter tuning and has fewer control parameters, making it suitable for a wide range of optimization problems. PSO also has a good balance between exploration and exploitation, allowing it to escape local optima and converge to global optima in many cases.

VII. FUTURE ENHANCEMENT

While Particle Swarm Optimization has been successful in many applications, there are still several areas where further research can be conducted to improve its performance and extend its capabilities:

Hybridization: Hybridizing PSO with other optimization techniques or metaheuristics can potentially enhance its performance. This includes combining PSO with evolutionary algorithms, simulated annealing, or local search methods to take advantage of their complementary strengths.

Constraint Handling: Incorporating constraint handling mechanisms into PSO can enable it to handle constrained optimization problems more effectively. Developing techniques to handle both equality and inequality constraints can improve the applicability of PSO in real-world problems.

Multi-objective Optimization: Extending PSO to solve multi-objective optimization problems is an active area of research. Developing algorithms that can efficiently handle multiple conflicting objectives and generate a diverse set of Pareto-optimal solutions is an important direction for future work.

Dynamic Optimization: Adapting PSO to dynamically changing environments or problems where the objective function or constraints evolve over time is another interesting research direction. Designing mechanisms to efficiently track and respond to changes can improve the robustness and adaptability of PSO.

Parallelization: With the increasing availability of parallel computing resources, exploring parallel versions of PSO algorithms can lead to significant speedup and scalability. Utilizing parallel architectures such as GPUs or distributed computing frameworks can enable PSO to handle larger-scale optimization problems.

Real-world Applications: Applying PSO to real-world problems in diverse domains such as engineering, finance, logistics, and healthcare can uncover new challenges and opportunities. Collaborations between researchers and domain experts can facilitate the development of problem-specific enhancements and adaptations of PSO.

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